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Assessing the Competitiveness of the Portuguese Metalworking Sector

João Marinho and Pedro Carvalho

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Abstract:

The main goal of this paper is to find the fundamental determinants of competitiveness within the Portuguese Metalworking industry, which is measured by both the Export Status and the Export Intensity of a firm. This sector is absolutely vital to the Portuguese Economy and it is characterized by its highly exportable profile. Moreover, its heterogeneity makes the sector sole in its analysis and asks for a more thoughtful and contemplative enquiry. Therefore, exploiting a two-step approach using a Probit and a Fixed-Effect estimator, for Portuguese firm-level data from 2010 to 2015, we try to answer two research questions: which characteristics are associated with exporter firms? And then, within the group of firms that export, which are the characteristics related to higher levels of export Intensity? Interesting results were then yield showing that factors such as investment in fixed tangible and intangible assets, productivity (Total Factor Productivity), having previously exported and, one of our most relevant findings, capital intensity are associated with an increase of internationalization and thus of competitiveness.

JEL Classification: D22

Keywords: Metalworking, Exports, Competitiveness, Firm-level data.

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[2] Strategy and Research Office, Ministry of the Economy. Nova School of Business and Economics, Universidade Nova de Lisboa.

[3] Strategy and Research Office, Ministry of the Economy. Nova School of Business and Economics, Universidade Nova de Lisboa.

1. Introduction

The Metalworking sector is one of the highest exporting sectors among the Portuguese Industries, contributing positively to the Portuguese Trade-Balance. Along with other vital industries in Portugal the metalworking sector throve throughout the years to improve its competitiveness mostly through increasing it export intensity[4] and orientation to the external market. Notwithstanding, as we consider this as a proxy for competitiveness we do not disregard the importance of the internal market and its possible influence in a firms' effectiveness. Following previous studies that have been conducted to reveal the main drivers of other industries in Portugal, such as the footwear, our study aims to strength this kind of analysis as it scope helps to understand the successful underlying stories presented in the Portuguese Economy.

Therefore, this study follows a firm-level data econometric approach that reveals the most important and vigorous determinants of competitiveness regarding Portuguese firms from 2010 to 2015 operating within metalworking sector which belongs to the extensive Manufacturing industry.

The metalworking sector is particularly interesting to analyse mainly due to its heterogeneity which makes it unique when compared to other economic activities. The metalworking sector is huge in its activity and deserves to be considered carefully since each competent of the global value's chain has its main specifications. Therefore, we used a thoughtful aggregation following the AIMMAP and Bank of Portugal suggestions and methodology dividing the main Classification of Economic Activities into three main subdivisions that we will further explore. Competitiveness is widely defined in the literature using proxies being the most likely for our purposes the Export Intensity which explains the competitiveness of a firm regarding the value of its exports over its turnover. With this, we found ourselves with some methodological challenge that we solve by structuring this study in two main research questions: What are the main drivers for a firm to export? If the firm exports, what explains the percentage growth in its exports and consequently the increase in its competitiveness?

As a result, we found that if a firm has exported in the previous year it is a huge indicator of the likelihood to export today. Likewise, investment in tangible and intangible assets (patents and R&D) in the previous year or two years ago will most likely make a firm export and increase its export intensity. Productivity and Labour Intensity are also an interesting case to address as we used a percentile methodology to compare the productivity and labour intensity from the top firms and conclude that firms that are among the most capital intense and more productive are more likely to export and therefore to increase its competitiveness.

All in all, we will support the general and initial idea of the Metalworking sector as the most exporter one, by giving a small national outlook, since 2010, for the reader to have a better idea and understanding of the overall sector performance regarding the small period which we aim to study. After this brief introduction, we do a wide literature review on competitiveness and its factors as well as search for both Portuguese literature about the Metalworking sector and evidence on industry sectors heterogeneity worldwide. Chapter 4 extensively describes the data used for the study provided by the Sistema de Contas Integradas das Empresas (SCIE) database followed by the selected variables, a broad descriptive statistic and focus on evidence on the sector heterogeneity. Chapter 5 presents the methodology, mainly econometric at a micro-data level using a two-step approach and the final chapter, Chapter 6, presents

[4] According to ***Altomonte et al. 2012***, Export intensity is a measure of competitiveness.

and supports the empirical findings of both models. As a closing remark, we shall review our results carefully and offer some future advice plus suggestions for some more feasible policy recommendations and extensive studies.

2. National Overview: Exports and Imports of the Metalworking Sector

We indeed advocate that the Metalworking sector is vital for the Portuguese economy and it is special due to its export orientation. Due to lack of data, we were not able to pull off a more insightful analysis regarding the overall performance as well as to compare with other countries, but we did a small numeric analysis to understand better how the sector behaves and where it is heading to. Hopefully, this gives the reader a better idea of the aim of this study as well as an even better understanding of the trend and the future of the sector by determining its key factors of success regarding competitiveness.

As we can see by looking at Table 1 there is a clear surplus in the balance between exports and imports in the years studied being the values always around 4 thousand million €. Since 2010 the exports presented an average growth of 4.9% while imports had an average growth of 4.3%. The Coverage Ratio which also explains the relationship between those macroeconomic indicators has always been in favour of good performance with an average 63.3% of the total imports being covered by exports.

Table 1 - National Overview - Author's Calculation

	2010	2011	2012	2013	2014	2015
Imports	6.426.113,450€	7.504.879,983 €	6.467.850,206 €	6.777.526,508€	6.954.925,084€	7.740.332,789€
Exports	9.633.213,336 €	10.991.490,662 €	11.006.836,131€	10.961.546,791€	11.393.325,806€	12.204.168,899€
Balance	3.207.099,886 €	3.486.610,679 €	4.538.985,925€	4.184.020,283€	4.438.400,722€	4.463.836,110€
Coverage Ratio[5]	66,71%	68,28%	58,76%	61,83%	61,04%	63,42%

In the following table 2, we present other interesting conclusions regarding this matter. The desegregation describes the three main subsectors of the industry that will be explained toughly in advance in Chapter 4. By now, we shall concentrate on the Diversification ratio that might be perceived as a way of risk pooling by the Portuguese firm's operation in the sector. As we can see, Portuguese firms maintain a constant ratio of diversification being it computed as the number of firms that export to both the European Union and outside divided by the total number of firms. The numbers might seem low, especially for the Metal and Electrical Products but they represent a reasonable portion of firms that are more and more trying to export to other geographies. Notwithstanding, the small percentages might be explained by the important role of the Portuguese metalworking industry in Europe having its main markets inside the European Union which is *per se* a justifiable and perhaps sufficient market for some firms to operate in. It is important to stress that since the firms are mainly small and medium could not have the capacity to compete with other countries outside the free-market European zone as they benefit from agreements that are sufficient to succeed at the internal European level comparing, for example, with Chinese companies that have to face tariffs.

[5] Relationship between the imports and exports, in value €, per year. (Exports / Imports) *100

Table 2 - Diversification ratio - Author's calculation

Diversification ratio	2010	2011	2012	2013	2014	2015
Basic Metallurgy	14,72%	14,93%	14,75%	14,16%	15,89%	14,42%
Metal and Electrical Products	5,81%	6,47%	6,88%	7,31%	7,94%	8,15%
Transport Equipment	20,34%	22,13%	23,62%	22,06%	23,97%	24,01%

3. Literature Review

Competitiveness is indeed one important and studied topic among the literature. For example, the OECD (2005) classifies competitiveness as the ability to trade goods, under free and fair conditions in global markets, while at the same time preserving a sustainable growth in the real income over the long term. However, it is difficult to find the right and most accurate proxy to study it. Being the main argument of this study, our revision and description is based on the most accurate determinants that might explain a firm's competitiveness. Amongst the various definitions, Krugman (1996) rejects the concept of national competitiveness, focusing more on the topic of International trade, viewing an experienced firm as competitive at a firm level which we will focus on. Moreover, other authors define it differently and try to justify competitiveness at both international and national level advocating that a firm competitiveness is not related only to its exports capacity. Altomonte et al. (2012) discuss a country's competitiveness more aligned with our beliefs suggesting that a dynamic export sector should be seen as a measure of a country's competitiveness as well as the export intensity might be a good proxy to measure it. It is important however to stress the importance of exports and its link with economic growth and productivity. Salomon & Shaver (2005) see exports as the most common form of international expansion and, as well as Bernard & Jensen (1999), advocates the importance of it to economic growth and productivity showing that they are positively correlated.

Correia & Gouveia (2016) also back that internationalization of firms is an indicator of their competitiveness while showing that policies that promote innovation and investment might create a positive impact on the firm-level probability of exporting. Indeed, literature is confident in saying that exporting firms are more efficient than the non-exporting ones. Moreover, an approach to calculate productivity is related to the total factor productivity (TFP) as is described in Comin (2010) as *"…the portion of output not explained by the amount of inputs used in production. As such, its level is determined by how efficiently and intensely the inputs are utilized in production.".* This is also corroborated again by Correia & Gouveia (2016) and Levinsohn and Petrin (2003) to explain the part of a firm´s revenues that is not clarified by both labour and capital and that is connected to technology and some efficiency gains acquired in the productive process.

By exposing the learning-by-exporting hypothesis Mariasole et al (2013) demonstrate that trough experience in external markets; Italian SME's were able to increase their competitiveness by accessing shared knowledge in global value chains. This theory is also attested widely in economic studies in what is called learning curves or learning economies. In addition, the previous history matters according to E. Sinani & B. Hobdari (2000), since they tested for firms that have been exporting the last period or the period before increased the probability of exporting in the presented period.

As what happens exactly in the case of the metalworking industry in Portugal, Fabling & Sanderson (2013) sustains that firms which enter the export market tend to be larger in size, more productive and much more capital intensive than those which remain domestically focused, E. Sinani & B. Hobdari (2000), test for impact regarding labour and capital intensity and describe the latest as *"expected to be more productive and to produce high quality goods, and, therefore, are more likely to export."*

In similar works studying for firm-level data like Greenaway & Kneller (2004) did for the United Kingdom was found that higher wages increase a firm's likelihood to export. This result is also confirmed again by Correia & Gouveia, this time studying for Portuguese firms. The causality is however hard to define since this effect can be due to more competitive firms paying higher wages, rather than wages driving competitiveness creating a self-selections bias. Additionally, Batista, Eduardo Matos & Costa Matos, (2017) conclude that there is a positive effect of average wages on turnover per worker.

The idea and effect of subsidises are still very uncertain especially due to its classification and ultimate goal in each country of study. In this topic, Safi (2010) claims that the effect of subsidies on exports is always negative in the cases of perfect competition, but if the competition is imperfect the trend may be positive. Haq & Kemal (2007) found a negative relationship between indirect and direct subsidies on export performance at least in the long-run. Studying for India export subsidies, Panagariya (2000), found a slight but positive impact. Batista, Eduardo Matos & Costa Matos, (2017) therefore expected for the Portuguese case that subsidies receivers to be more competitive and export more, therefore having a positive impact as well.

Both Caloff (1994) and Correia & Gouveia (2016) found evidence that size in the previous period to be in fact a significant variable. Notwithstanding, empirical literature is not consensual at all when talking about the size of a firm and its impact on competitiveness since Monteiro (2013) and Moen (1999), found opposite results. For the Norwegian case, it is suggested that the small and medium firms have diverse competitive advantages than larger firms, not being necessarily less competitive.

Bellone et al (2010) found that better financial strength improves the chance of a firm to become an exporter. Financial pressure and negative equity can indeed limit a firm's capacity to acquire more debt and possibly to invest with the ultimate goal of increasing performance, and through it, improve competitiveness. Along with it, the assortment of debt-to-equity ratio has received increasing attention in recent years as Tai-Leung Chong, Law & Yao (2016) focused on the determinants for this ratio for Japanese firms advocating that more important than its impact itself is the orientation it has compared to its peers and the target market.

Correia & Gouveia (2016) robustly affirm that younger firms are more disposed and likely to export as for gain with the learning effects from the export activity. Others empirical studies show that new companies have the ability to export immediately just to resist the fierce competition presented in the internal market especially after the 2008 financial crisis.

Among the existent definitions of relevant market and competition indexes Amador & Soares (2014) advocate that the standard in the literature is to use an economic activity classification and defines the relevant market as a 3-digit level in NACE Rev.1.1. This applies to the Portuguese market with the 3-digit code for CAE's.

Finally**,** Boehea & Jiménez (2016) using a panel of longitudinal archival data for Brazilian firms found a relationship between export intensity and diversification of exports within different geographic areas. Their findings are robust as they have different research questions an answer them by advocating that the diversification effect depends indeed on the geography's and export intensity level a priori creating a causality effect hard to define. Overall, they sustain that for high export intensity firms the diversification is good and improves export intensity to some extent, and then it becomes costly to expand. In what low export intense firms are concerned diversification follows an S-curve relationship with the previous variable being delicate to analyse.

Regarding the Metalworking sector, there is not a relevant amount of literature at all relating to competitiveness neither in Portuguese case nor in other economies. Moreover, it is also hard to identify scientific work on how to study for sector heterogeneity. Still, the authors have surveyed some articles and other works worth mention. Indeed, being the Metalworking industry a vital sector to the Portuguese economy as well as the Footwear sector a closer approach to Batista, Eduardo Matos & Costa Matos, (2017) was followed.

J. Rodrigo Guerreiro et al. (2015), for the study of the manufacturing industry in Portugal, found that market size and past macroeconomic conditions are central determinants of entry rate in the industry. In the same line, Eugénia P. Costa, Ana Fortunato and Catarina Afonso in a more descriptive study aim for the competitive advantages of Portuguese firms in the same industry and following a sub-sector analysis.

Variable	**Author**	**Beta**
Previous Exporter	Mariasole et al (2013), E. Sinani & B. Hobdari (2000),Fabling & Sanderson (2013)	**+**
Financial Pressure	Bellone et al (2010)	**-**
Productivity	Correia & Gouveia (2016), Levinsohn and Petrin (2003)	**+**
Wages	Correia & Gouveia (2016), Greenway & Kneller (2004), Batista, Eduardo Matos & Costa Matos, (2017)	**+**
Debt-to-Equity & Negative equity	Marques (2013),Tai-Leung Chong, Law & Yao (2016)	**- / +**
Size	Marques (2013), Caloff (1994), Correia & Gouveia (2016), Monteiro (2013), Moen (1999)	**- / +**
Subsidies	Safi (2010), Haq & Kemal (2007), Panagariya (2000), Batista, Eduardo Matos & Costa Matos, (2017)	**- / +**
Relevant Market	Amador & Soares (2014)	**0**
Age	Correia & Gouveia (2016)	**-/+**
Diversification	Boehea & Jiménez (2016), Batista, Eduardo Matos & Costa Matos, (2017)	**+**
Labour intensity	E. Sinani & B. Hobdari (2000), Fabling & Sanderson (2013)	**-**

4. Database description

4.1 The dataset

The dataset used in this study is provided by the Database from the *Portuguese National Statistical Institute* (Instituto Nacional de Estatística - INE) and it is called SCIE – *Sistema de Contas Integradas das Empresas* being mainly an assembling of annual data collected from the Portuguese firms between 2010 and 2015, concerning our sample. As a matter of fact, a larger sample ranging 2004 to 2015 was provided but after running a battery of tests we decided to restructure our dataset in order to obtain a more robust and coherent model using more accurate data, eliminating therefore methodological problems that were arising especially due to missing values in vital variables. Not only the decision related to the time period, but also other treatments were made regarding the turnover, production and the exports themselves. First things first, a threshold to drop observations was defined concerning the turnover and production of a firm set on 50.000€ per year. The choice of this value, even though randomly assigned at the margin, was to avoid firms that were created let's say by an employee of other firms just to do a few services. This could bias our model.

Nevertheless, the authors are aware of the trade-off when one must choose a threshold like this, namely that will exclude firms with the above-undesired characteristics and, at the same, exclude firms that are just not having so much success and therefore having a low production and/or turnover, which would be desirable to maintain. These values were found coherent and backed by AIMMAP (Portuguese Metalworking Association). Finally, we used the Criteria of Bank of Portugal[6] to define if a company was an exporter along with exporting above zero (in euros, per year) but decided to go with the first as it was definitely stricter nonetheless also more compelling.

Within the SCIE database, a selection was made for our sample based on the economic classification 5-digit code (*CAE – Classificação das Actividades Económicas*) that concerned our industry, essentially the metalworking sector operating within the manufacturing. This study as the caveat of assessing the competitiveness predictors for this sector and its subsectors due to the heterogeneity presented within the value chain of the Metalworking sector. Being so, the first subsector goes from the 5-digit Classification 24100 to 24540 which is included in *CAE 24*. We will further describe this subsector as **Basic Metallurgic**. In the next subsection, **Metal and Electrical Products**, we have activities from 25110 to 257992 referring to Metallic Products (25), 27000 referring to Electrical Equipment (27), 28110 to 28992 belonging to Machinery and non-electrical equipment (28). At last, with activates from 29100 to 29320 referring to Motor Vehicles (29) and 30000 to 30990 (other transport equipment), we have the third Subsector **Transport Equipment**. Consequently, due to the heterogeneity of the Metalworking industry, it was advisable to divide the industry into three subsectors described above following the AIMMAP advises and Bank of Portugal Methodology:

- **Sub-Sector 1**[7] - Basic Metallurgy - including CAE 24
- **Sub-Sector 2**- Metal and Electrical Products - Including CAE 25,27 and 28
- **Sub-Sector 3**- Transport Equipment – CAE 29 and 30

[6] According to this criterion a firm is considered an exporter if at least 50% of annual turnover is from exports or at least 10% of annual turnover is from exports with a value greater than 150.000€.
[7] For convenience in our study we use the abbreviation **SS** as Sub-Sector having then Sub-sector 1, 2 and 3 compelling the described CAE's.

Being this said, our initial study of the market and the industry itself found other activities merely relevant for this paper - such as 33 and 31 mostly referring to the repair and maintenance of machinery and equipment - but they carried a lot of risks. A joint analysis of the other economic activities could easily undermine our results and a sole analysis into another new category would be fairly poor and less robust than the others. Consequently, we decided to leave it out of our analysis.

Table 3 - Percentage of Exports over the years- divided by subsector - Author's Calculation

	Basic Metallurgy	Metal and Electrical Products	Transport Equipment	Metalworking Total
	% exporters	% exporters	% exporters	% exporters
2010	34,2%	28,0%	39,4%	28,9%
2011	35,3%	28,5%	40,4%	29,4%
2012	38,2%	29,6%	42,6%	30,6%
2013	38,4%	29,9%	41,5%	30,9%
2014	40,2%	30,0%	42,1%	31,0%
2015	39,9%	29,6%	42,4%	30,7%

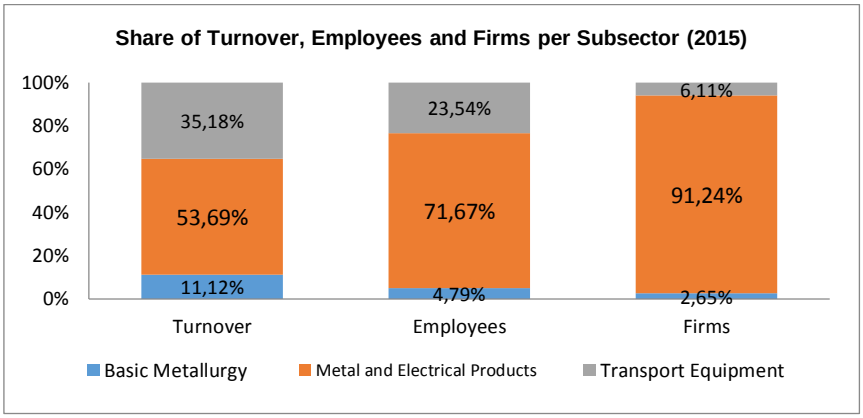
When all is said and done, our final panel consists of *130.313* observations with *20.954* firms. As we can see in Table 3, the average of exporting firms it is about ***30%*** for the all industry and the values, for all metalwork industry, vary within 2 percentage points throughout the years representing an average increase of 1.23% per year. The Transport Equipment subsector contributes relatively more than the others two, but there is not much of a difference only attesting to robustness regarding our previous assumptions about exports in our study. Even though 30% doesn't look much, at first sight, one should bear in mind that this is solely an indicator of the percentage of exporting firms. When accounting for the turnover in our proxy for competitiveness the results change considerably.

Table 4 - Number of companies according to subsector and size over the years - Author's Calculation

	Micro			Small			Medium			Large		
	Basic Metallurgy	Metal and Electrical Products	Transport Equipment	Basic Metallurgy	Metal and Electrical Products	Transport Equipment	Basic Metallurgy	Metal and Electrical Products	Transport Equipment	Basic Metallurgy	Metal and Electrical Products	Transport Equipment
2010	123	5508	249	61	2031	165	33	368	82	14	44	35
2011	116	5165	240	60	1946	147	31	371	76	14	42	34
2012	114	4767	221	61	1809	146	32	348	69	10	43	34
2013	117	4719	232	57	1760	128	35	330	73	10	42	34
2014	117	4776	222	53	1781	129	33	365	77	11	41	35
2015	105	4894	230	59	1836	130	36	379	82	8	42	37
Average % of total	**52.8%**	**68.7%**	**48.0%**	**26.8%**	**25.7%**	**29.0%**	**15.3%**	**5.0%**	**15.8%**	**5.1%**	**0.6%**	**7.2%**

By looking at Table 4 we can address the question of the number of firms, each year and divided by the respective Sub-sector and size. It is important to understand how the metalworking sector operates regarding its composition, likewise to see the different number of firms and their size. Therefore, we can easily see that: the number of firms has been relatively homogeneous over the years presented in the study making the analysis more compelling and realistic. Indeed, there are some firms that "died" and others that "born" especially for the Micro firms. Other than that, the subsector **Metal and Electrical Products** is by far the most representative. The percentage of medium and large firms is relatively small in our sample, never above 16% and 6% respectively.

Graph 1 - Share of the described variables for each subsector - Author's Calculation



To have a better idea of how the metalworking sector is composed we can look at Graph 1 and easily see the differences among the subsectors in three important domains such as Turnover, Employees and Firms in 2015. As shown, we can see that in all the mentioned categories the Metal an Electrical Products is by far the most expressive accounting for 53.69% of the overall turnover, more than half of the Metalworking sector. The numbers are even stagier as we proceed to the share of employees and firms whereas it accounts for 71.67% and 91.24% of the metalworking industry, respectively. Followed by Transport Equipment as the second most representative, Basic Metallurgy is indeed the less symbolic sector within the three presented and studied. Still, one should bear in mind that this indicator is purely descriptive and the importance of each sub-sector will be controlled by its overall size so we can draw more truthful conclusions.

4.2 Choice of Variables

First things first, we start by discussing our dependent variables, being or not an Exporter and Export Intensity, which was previously discussed and supported in the literature as a good proxy for competitiveness since the export success is linked to competitive firms (Richard Fabling & Lynda Sanderson (2012) and Altmonte (2012)). Notice that within a sector that is highly exportable is then important to address and try to understand the variations in the share of exports in firm's turnover.

When addressing this research question, we first believe that it is important to answer why are the firms exporting and what factors are causing such behaviour. In our two-step approach, we use the same range of variables with slight differences which are worth mentioning. First, diversification is used as a measure of risk, mainly it specifies if a firm export both for European Union and outside of it which can explain if firms are highly dependent or not on a specific common market or/and country. Since this measure, as we see it, helps to explain why a firm might improve its share of exports but not the exporter status. Moreover, the lags of the variables mainly of one period are vital in most of our variables as the effect of some variables is not instantaneous. A couple of control variables, as we call it, are also important to be included since they help us to make the model not scale-dependent. We used the size of the companies according to the European Commission definitions[8] and describe it in our model. The relevant market was defined as a 3-digit code of the economic classification which according to João

[8] European Commission size firm definition is determined by staff headcount and either turnover or balance sheet total: If a firm has less than 10 employees and a turnover and balance sheet total less than 2 million euro is considered Micro.
If a firm has less than 50 employees and a turnover and balance sheet total less than 10 million euros is considered small.
If a firm had less than 250 employees and less than 50 million euros turnover and 43 million euros balance sheet total is considered medium-sized. Large is then, the remaining.

Amador and Ana Cristina Soares (2014) is the baseline for a market in which firms compete. Variables such as year and region are also present to control for the possible macroeconomic effects and the region in which a company operates. Finally, fixed tangible assets and intangible assets are helpful concerning the control for different types of firms since in an industry so capital intensive this kind of assets help us to get a sense of the structure of the company. Moving on to the other variables we use the variable flow of the previous assets with one and two lags to help us predict the effect of investing in such assets, thus we also believe that an investment of that sort is only reflected in a firms' competitiveness from one or two periods after it is done. The lag of exports is also important in the sense that this variable helps to explain if a firm that had exported in the previous period will most likely export now, possibly even more and hence becoming more competitive. Subsidies (Arvind Panagaryia, 2000; Nadeem Ul Haque and M. Ali Kemal 2007) are incentives given by the Government to firms in order to engage these firms in new activities and invest in things such R&D (Alka Chadha 2009; William R. DiPietro & Emmanuel Anoruo, 2005) and Human Resources, mainly increasing the know-how of its employees.

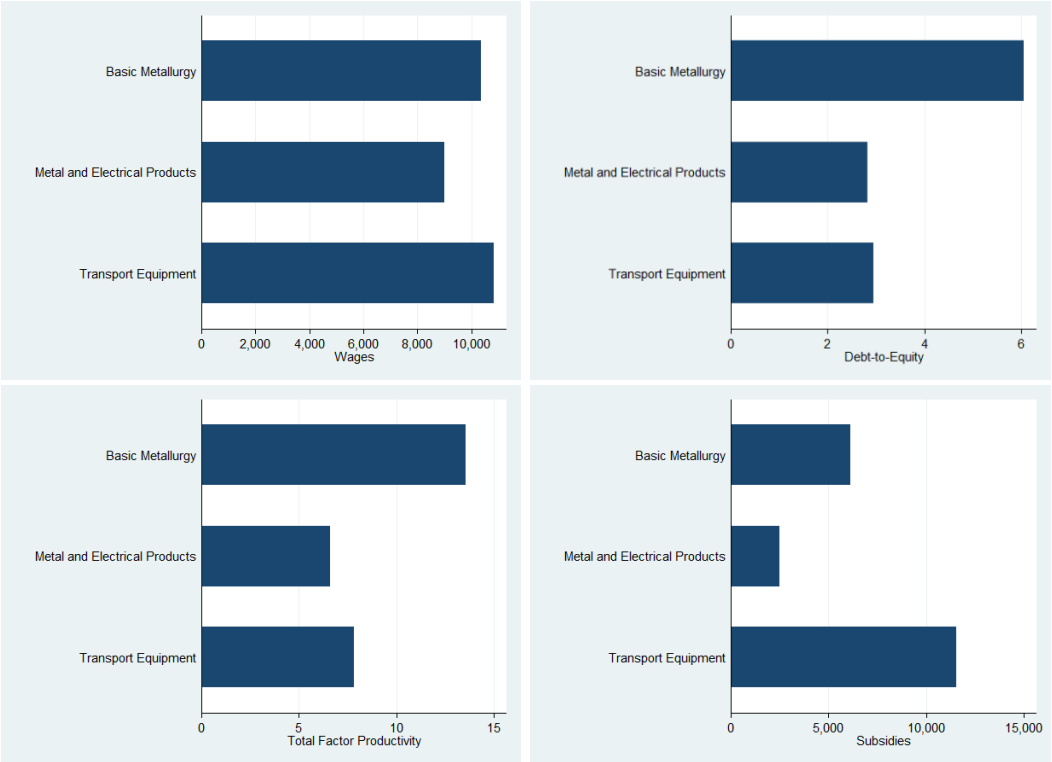
Concluding, we have the following variables regarding productivity and the financial strength of a company. We establish Financial Pressure (Flora Bellone, Patrick Musso, Lionel Nesta and Stefano Schiavo 2010) as the value of net interest over EBITDA, Debt-To-Equity as a leverage ratio using debt over equity and negative equity that could give us further information. The first one, financial pressure, captures the effect of the share of interest rates in the EBITDA. The reasoning follows that if a company which presents a high share of this parameter may have fewer opportunities to invest and eventually not become so competitive. It is also important to stress that the model controls for the situations negative net interest, negative EBITDA and when these two cases happen at the same time. Regarding Debt-to-Equity, we can draw some conclusions looking at this financial ratio to see the capacity of financial leverage from the Portuguese firms and, similarly to the previous ratio, the case of negative Equity was also taken into consideration.

Finally, and probably the most important measures we calculated the labour intensity and a total factor productivity to explain some competitiveness capacity. In 2000, Evis Sinani and Bersant Hobdari found that capital intensity firms are more likely be exporters and we had a prior belief that our industry was by far capital intensive. As a result, we used labour intensity in our model, so we can get the opposite effect and a set of information about the capital intensity. In 2016 Ana Luísa Correia and Ana Gouveia found total factor productivity as a good measure to study firm-level heterogeneity and productivity when comparing the top percentile firms among its peers. In that sense, our total factor productivity was computed using the Levinsohn and Petrin (2003) approach which is widely used in the literature. Regarding its computation and reasoning, the total factor productivity (TFP) aims to explain the technological process and catching-up effects as so other efficiency gains that might exist in the manufacturing process of a firm. Hence, it works as a residual of a production function being this remaining the part of a firms' revenue (turnover in our concrete case) that is explained neither by the inputs of labour nor by capital. Besides the variables turnover, wages and capital we used energy and material costs as a proxy for the inputs of the unobservable features of productivity. Then, we compute the percentiles of the top 25, 50 and 75 firms to get more information and to see not only the overall but similarly the effect of a marginal difference. This is one of the features of our model that we will get into details later.

4.2.1 Evidence on firm-level and subsector heterogeneity

Presented below we have a set of important charts aiming to explain and support our impression of the presence of a sector highly heterogeneous[9].In that sense, we present three different subsectors regarding a couple of interesting determinants used in this study. Starting by Box 1 we can see that the difference in the subsidies across sub-sectors receives varies widely. The variable Wage is the more homogenous one. According to our calculations, the average wage is similar across subsectors with special emphasis on Basic Metallurgy and Transport equipment. The Debt-to-equity ratio also shows a clear difference between Basic Metallurgy, with a mean of 6, and to the other two subsectors, of 2.5. The Total Factor Productivity is higher on the Basic Metallurgy subsector followed by Transport and Equipment.

Box 1 – Comparison of the size of each variable regarding each subsector- Author's Calculation



4.3 Descriptive Statistics

Table 5 - percentage of exporting firms as a dummy variable- Author's Calculation

% Exporting Firm - Average	Non-exporter (0)	Exporter (1)
Basic Metallurgy	62,30%	37,70%
Metal and Electrical Products	70,72%	29,28%
Transport Equipment	58,60%	41,40%

[9] Here, following the association endorsement, we used the desegregation approach of Bank of Portugal explained previously in section 4.1.

As it is known the Metalworking industry a highly export sector contributing in a major way to the Portuguese trade Balance. As proven by the table 5, as an overall average within our sample, we can see that the percentage of exporting firms varies widely within the subsectors being Transport Equipment the most exporting sector followed by Basic Metallurgy. It is, however, important to stress that the three subsectors have a high percentage of exporting firms advocating for the two-step model approach that we will indeed explain carefully in the next section. Interesting enough, the most exporting subsector is with no surprise the one with a higher rate of exporting intensity, being this variable the most important one since it upholds the share of the exports on turnover which is by far much more indicative that the rate of exports itself. In Graph 2 we can then see that the 3 subsectors follow the same pattern as before despite the differences in its turnover. Given our sample, one can see that the export intensity in the Basic Metallurgy and Transport Equipment is in all the years, except for 2010, above 50% being the Metal and Electrical products the sector that points out to be different. We duly note, however, that these results are constrained by a lot of small and micro firms that might be forcing them, still important to address and study.

Graph 2 - Export intensity over the years by subsector- Author's Calculation

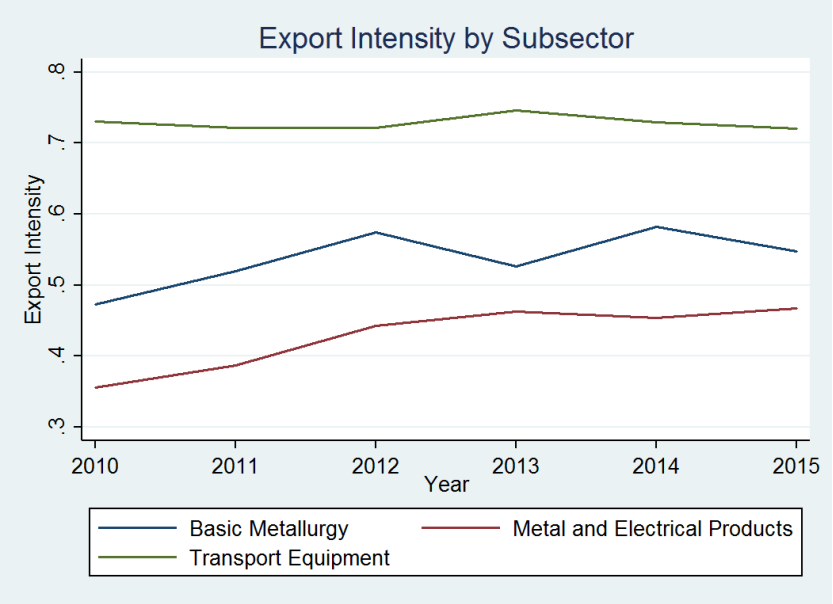


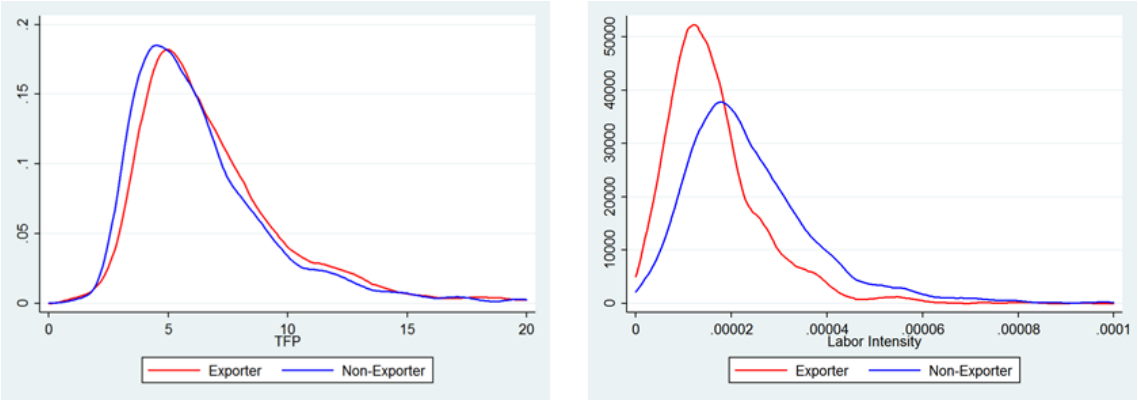
Table 6 reports the mean differences, regarding 2015, between Non-exporting and Exporting firms for the overall industry. It presents some of the most important variables being most of them presented in our statistical model corroborating even more our beliefs. As one can see all the described variables prove to be very different and have a significant impact on the competitiveness of a firm depending on its status at a high statistical level. Only the financial measures do not present significant differences between the two classes of firms. Just as an illustration purpose, an exporting firm has on average 32 more employees and has a turnover 6.364.143,30 € higher. It is also more productive and has higher labour cost being perhaps this one of the most relevant results we wanted to point out since the beginning.

Table 6 - Mean differences between Non-exporting and Exporting firms for the overall industry in 2015 - Author's Calculation

2015	Non-exporter (0)	Exporter (1)	Mean Differences
Turnover	800.001,70 €	€7.164.145,00 €	-6.364.143,30 €***[10]
Employees	10,101	42,987	-32,887***
Production	715.172,10 €	11.800.000,00 €	-11.084.827,90 €***
Operational profit	40.896,60 €	677.737,80 €	-636.841,20 €***
TFP	6,666	7,476	-0,810***
Labour Intensity	2,45E-05	1,65E-05	8,00E-06***
Labour cost	171.647,10 €	1.626.052,00 €	-1.454.404,90 €***
Investment intangible assets	1.086,64 €	22.176,86 €	-21.090,22 €***
Investment Fixed tangible assets	41.707,98 €	521.224,40 €	-479.516,42 €***
Investment R&D	28,19 €	2.161,90 €	-2.133,71 €***
Average Wage	8.108,00 €	13.160,76 €	-5.052,76 €***
Subsidies	1.404,26 €	17.445,24 €	-16.040,98 €***
Fixed tangible assets	211.109,30 €	2.648.528,00 €	-2.437.418,70 €***
Intangible assets	2.784,57 €	61.015,37 €	-58.230,80 €***
Financial Pressure	-46,9%	4,2%	-51,1%
Debt-to-equity	2,998	2,659	0,339

The differences in the Total Factor Productivity in 2015 can be observed in Graph 3. The density distribution of Exporter firms is slightly concentrated on higher values compared to non-exporter firms. Notice that for both groups, as expected, the accumulation of TFP is concentrated on low levels of the distribution. At the right in Graph 3 as well, the distribution of Labour Intensity is displayed across firms, again, distinguishing between Exporters and Non-exporters in 2015. The average Labour Intensity share is higher in Non-Exporters than in Exporters. This is an expected result as there are subsectors that use intensively factors such as capital.

Graph 3 - TFP and Labour Intensity - Exporter VS Non-Exporter

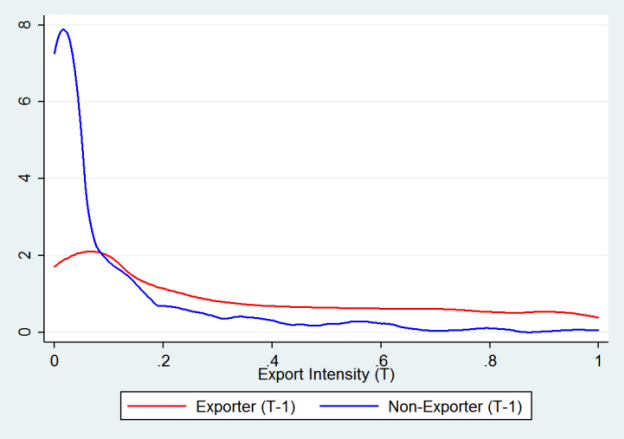


[10] *significant at p<0.1, **significant at p<0.05, ***significant at p<0.01.

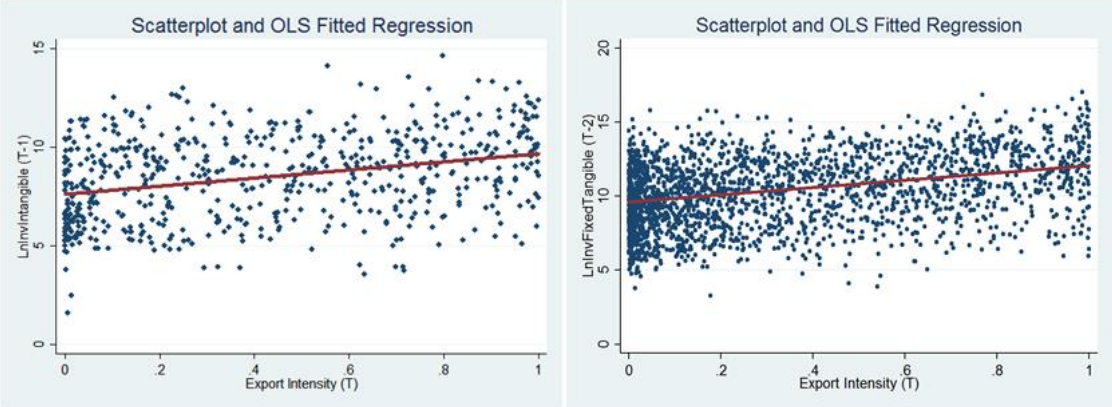
Graph 4 displays the kernel density of Export Intensity for the case where the firm was an Exporter in the previous year. The distribution of Export Intensity on firms that were not exporting in the previous period is concentrated in values that are smaller than 0.1. The exporters' case presents a flatter distribution, resulting in higher concentrations in higher levels of export intensity compared to the case of Non-Exporters.

This support the theoretical framework where having past experience in international activities increases the Export Intensity of a firm revelling the importance of know-how and networking as well as engaging in international projects.

Graph 4 - Export Intensity - Exporter (t-1) VS Non-Exporter (t-1)



Graph 5- Export Intensity - Intangible vs Tangible assets in different periods



On Graph 5 we can observe a similar behaviour between Export Intensity and investment in intangible assets, two periods lagged, and Export Intensity and investment in fixed tangible assets, one period lagged. They suggest a positive relationship between Competitiveness and investment both in intangible and tangible assets within the Metalworking Industry.

5. Methodology

In this paper, we examine the determinants of competitiveness of the Portuguese Metalworking Industry using firm-level data from 2010 to 2015 by estimating those using a two-step model approach. As stated before the level of internalization of a firm can be seen as a proxy for its competitiveness. Hence,

we present two different models explaining first, what are the factors associated with an exporter firm and second, what determines the weight of exports on the turnover of the firm. In the first step, a binary variable was used indicating the export status[11]. The associated factors were estimated using a probit regression model. On the second step, the dependent variable is the export Intensity which can be defined as the share of exports by turnover. A fixed effect estimator was used to calculate the determinants of export intensity as it allows to account for specific unobserved characteristics of each firm[12].

The following probit regression examines what features explain the probability of a firm to become an exporter. When necessary, several lagged variables have been used to find the causal economic effects. The model can be described using the following equation:

$$Exporter_{t,i} = \beta + InvIntang_{t-1,i} + InvIntang_{t-2,i} + Invtang_{t-1,i} + TFP_{t,i} + Exporter_{t-1,i} + LaborIntensity_{t,i} + \text{AvgWages}_{t,i} + SubsidyRecipient_{t-1,i} + FinancialPressure_{t-1,i} + DebtToEquity_{t-1,i} + NegEquity_{t-1,i} + NegEbitda_{t-1,i} + NegInterest_{t-1,i} + NegInterest\&EBitda_{t-1,i} + NegDebttoEquity_{t-1,i} + FixedTangAssets_{t-1,i} + IntangAssets_{t-1,i} + Year_i + NewBorn_i + Market_i + Size_{t-1,i} + \mu_{t,i}$$

The second model aims to explain variations on the weight of exports in firms' turnover, Export Intensity, accounting only for firms that export. A Hausman test was performed to back our previous economic reasoning on using a fixed-effect estimator attesting that is indeed the one that fits better this study. Additionally, previous evidence of heteroscedasticity in the model was then corrected using this approach that consents for robust standard errors making inference possible and precise. Finally, The R-squared was found using an absorption regression command on *STATA* and due to the heterogeneity of the sector we performed several interactions on the different subsectors. The following equation describes the Fixed Effect Model:

$$\begin{aligned} ExportIntensity_{t,i} &= \alpha + InvIntang_{t-1,i} + InvIntang_{t-2,i} + Invtang_{t-1,i} + TFP_{t,i} + Exporter_{t-1,i} \\ &+ LaborIntensity_{t,i} + \text{AvgWages}_{t,i} + +Diversification_{t,i} + SubsidyRecipient_{t-1,i} \\ &+ FinancialPressure_{t-1,i} + NegEquity_{t-1,i} + DebtToEquity_{t-1,i} + NegEbitda_{t-1,i} \\ &+ NegInterest_{t-1,i} + NegInterest\&EBitda_{t-1,i} + NegDebttoEquity_{t-1,i} \\ &+ FixedTangAssets_{t,i} + IntangAssets_{t,i} + Year_i + NewBorn_i + Market_i + Size_{t-1,i} + \omega_i \\ &+ \varepsilon_{t,i} \end{aligned}$$

Therefore, to explain the degree of internationalization (thus competitiveness) both models include the stock and flow variable regarding tangibles and intangibles assets, wages, subsidies, previous experience in exporting, factors intensity, namely labour intensity, financial strength (financial pressure, debt to equity, Negative Equity and negative EBITDA), size of the firm, productivity and the year of birth. Furthermore, it was also controlled for the market where the firm is included and for the year. It is important to stress that in the fixed effect model was also included a binary variable, Diversification, with value 1 if the firm exports both to European Union and non-European Union countries.

[11] According to the definition of Bank of Portugal.

[12] Robust Standard Errors, clustering on firms, were also taken into consideration.

6. Empirical Results

Output 1 presents the Probit model being the dependent dummy variable exporter, whereas a firm export or not according to the Bank of Portugal Criteria, while Output 2 shows the results of a fixed-effects panel regression of our dependent variable Export Intensity on a collection of explanatory variables.

Output 1 – Probit Model[13] and its Marginal Effects[14]

Dependent Variable	$Exporter_t$									
	Coefficients				**Marginal Effects**					
Interaction Type		Basic Metallurgy	Metal and Electrical Products	Transport Equipment		Basic Metallurgy	Metal and Electrical Products	Transport Equipment		
Inv_Intang_{t-2}	.1884139***				.0346492***					
Inv_Intang_{t-1}	.1046075**				.0192372**					
Inv_Tang_{t-1}	.2169904***				.0399044***					
TFP_t	.0827756***				.0152224***					
$Exporter_{t-1}$	--	2.37112***	2.465125***	2.735107***	--	.4360471***	.4533344***	.502984***		
$Labor\_Intensity_{t-1}$[15]	-.0123369***				-.022688***					
$AvgWages_t$	1.50e-06				2.76e-07					
$Subsidy\_Recipient_{t-1}$	--	.4644955***	.1883552***	.1261891	--	.0854204***	.0346384***	.0232061		
$Financial\_Pressure_{t-1}$	.0030404				.0005591					
Neg_Equity_{t-1}	-.0725659				-.0133448					
$Debt\_to\_Equity_{t-1}$	--	.0028598	.0000157	-.0009762	--	.0005259	2.89e-06	-.0001795		
Neg_Ebitda_{t-1}	-.004091				-.0007523					
$Neg\_Interest_{t-1}$	-.0055407				-.0010189					
$Neg\_Int\_and\_Ebitda_{t-1}$	.0021372				.000393					
$Neg\_DebttoEquity_{t-1}$	-.0000682				-.0000125					
$Fixed\_Tang\_Assets_{t-1}$	-3.64e-09				-6.69e-10					
$Intang\_Assets_{t-1}$	1.22e-07				2.24e-08					
$Year$	-.0109602				-.0020156					
New_Born	.0243575				.0044793				**Pseudo-R^2**	92,1%
$Region$	.02348***				.0043179***				**Wald Chi2**	11498.52
$Market$	.0038535***				.0007087***				**Number of obs.**	31.014
$Size_{t-1}$	.4552361***				.0837175***				**Number of groups**	7.991
$Constant$	18.46454				--				**T**	3.9

[13] *significant at p<0.1, **significant at p<0.05, ***significant at p<0.01.
[14] We used the command margin, *dydx(*) atmean* in Stata to compute the marginal effects in order to be able to draw some conclusions on the impact of the variables in a binomial model.
[15] For interpretation purpose our variable was multiplied by 100.000 without loss of generality or scale effects.

Output 2 – Fixed-Effects[16]

Dependent Variable	$Export\_Intensity_t$			
Interaction Effects	**No**	**Yes**		
Interaction Type		Basic Metallurgy	Metal and Electrical Products	Transport Equipment
Inv_Intang_{t-2}	.0110792***			
Inv_Intang_{t-1}	.0043822			
Inv_Tang_{t-1}	.0108533**			
TFP_t	.0053108**			
$Exporter_{t-1}$	--	.0628816**	.0121655***	.0403218***
$Labor\_Intensity_t$	-.0300606***			
$AvgWages_t$	3.90e-07			
$Diversification_t$	.0458529***			
$Subsidy\_Recipient_{t-1}$	--	1.68e-07***	-7.30e-09	-3.01e-08
$Financial\_Pressure_{t-1}$	-2.16e-06***			
Neg_Equity_{t-1}	-.0120953			
$Debt\_to\_Equity_{t-1}$	--	.0000382	.0000127	.0000317
Neg_Ebitda_{t-1}	-.0000582			
$Neg\_Interest_{t-1}$	-.0044211			
$Neg\_Int\_and\_Ebitda_{t-1}$	.0065549**			
$Neg\_DebttoEquity_{t-1}$	-.0000317			
$Fixed\_Tang\_Assets_t$	4.68e-10			
$Intang\_Assets_t$	-5.51e-09			
$Year$	.0119719***			
New_Born	-.0586193			
$Region$	.0029414			
$Market$	-.00068			
$Size_{t-1}$	.0038089			
$Constant$	-23.55145			

R^2	89,30%
F-statistic	31.80
Number of obs.	16.009
Number of groups	4.344
T	3.7
Hausman(u,χ2)	486.95

[16] *significant at p<0.1, **significant at p<0.05, ***significant at p<0.01.

6.1 Investment in Intangible and Tangible

The investment both in tangible and intangible assets of a firm are of maximum importance to its competitiveness, as is hugely emphasized by literature. Investment in tangible assets consists in investment in the physical capital while investment in intangible assets includes investment in human capital, software and industrial property.

Our first model suggests that being in the top 10% firms of its relevant market in terms of investment in intangible assets, lagged with one and two periods, and in terms of investment in fixed tangible assets, lagged with one period, is associated with a higher likelihood of being an Exporter. Being one of the 10% firms that invested in intangible assets both in the previous two and one periods is related to a higher probability of 3.46 and 1.92 percentage points of being an exporter, respectively. Likewise, being in the top 10% firms that invest the most in intangible assets in its relevant market is associated with a higher likelihood of 3.99 percentage points of being an exporter compared to firms which are not included in this group.

Our second model shows similar results in qualitative terms. The main difference is the variable investment in intangible assets, with one lag period, appears as not being statistically significant which may be explained by the fact that one year is not enough to transform this investment into competitiveness measured as export intensity. Notice that the same variable lagged with two periods is associated with a higher export intensity of 1.1 percentage points. Similarly, belonging to the group of 10% of the firms that invested in the previous year in fixed tangible assets is associated with an increase of 1.1 percentage points in Export Intensity.

One limitation of investment in intangible assets is that firms may not accurately report this data. On the top of that, as stressed by the association (AIMMAP), this variable may not fully capture investment in intangible assets. One example is the investment in Patents where the value reported of this investment is the cost of getting the Patent which clearly does not reflect its true value. Furthermore, as an important part of employers training is conducted by shared resource centres it is not accounted for investment in intangible assets. Moreover, there is an important correlation between investment in intangible and tangible assets. As an illustration, an investment in new machinery (tangible) may represent the need for new software or new training (intangible).

6.2 New Born

The Variable New Born, computed as a dummy, aims to describe the year of birth of a firm and was included in our model with our prior belief that the age of a firm might impact positively its competitiveness. Why, one can ask, and the answer is straightforward just by explaining the concept of learning curves in the Metalworking sector. This concept in the economy describes the process of learning by doing which is highly presented in capital-intensive industries such this one. Thus, older companies should have higher productivity with lower costs; develop human capital and keeping obtaining know-how. Conversely, younger firms are more disposed to export according to Correia & Gouveia (2016).

With this, in our model, this variable was computed as a dummy which is triggered if the company was born before 2004, between 2004 and 2010 including both and 2011 inclusive onwards until 2015. The variable shows no relevance, that is, there is no statistical evidence that the year born has an impact on a firm competitiveness. Neither explains if a firm decides to export or not, being statistically not significant despite the coefficient of a marginal likelihood increase of 4.4 percentage points. The inclusion of the

variable has only its economic purpose and reasoning as having some possible explanations for its lack of relevance, at least, statistically. First, our data was observed between 2010 and 2015 and the lack of information before that, mainly regarding 2004, and before those years. In such a capital-intensive industry these learning curves need years to take place, so even if a company is 10 years old it might be too young to study. Also, other reasons might be linked with firms that born lately, mainly after the crisis, and with a more international mindset. They started to explore the exporting market instead of the internal due to the high competition and constraints, hence possibly undermining our conclusions. Literature is also still very sceptical relating this measure and further studies should be conducted.

6.3 Productivity – Total Factor Productivity

As explained before our productivity measure was computed using the *LEVPET* method and has the main feature of comparing the marginal effect between the top 25% companies regarding their total factor productivity. With this, about a firm's competitiveness, a variation in firms total factor productivity which makes it improve from the previous and least performer percentile (in terms of TFP) increases the export intensity of the same in 0.53 percentage points, on average, ceteris paribus. Moreover, the marginal effect on the likelihood of a firm becoming an exporter in the next period increases 1.5 percentage points, ceteris paribus. Literature widely uses this measure as others when talking about productivity reaching the consensus that it is an important trigger of competitiveness making the more productive firms the more competitive and thus, exporting more and having higher turnovers creating a self-selection bias. Recall not only is this demonstrated by Melitz (2003) and Alvarez & Lopez (2008) but also Bombardini et al. (2012) showing that there is a direct relationship in its causality. Exporting is, all in all, a consequence and cause of productivity growth. In this sense, our two-step model helps to explain this in detail since is both a cause to start exporting but also increase its intensity attesting to previous ideas describe in other works.

Our results are robust given the importance of this variable and others were used to test and study the model's behaviour. Following the Batista, Eduardo Matos & Costa Matos (2017) approach we defined labour productivity, as well as Gross Value Added, (in factor prices) per employee but we founded as of limited interpretation when comparing to our TFP and since both of them could damage our final results our efforts turned to the latest.

6.4 Previous Exporter

Following the reasoning of the New born variable as we aimed to explain the effect of experience in the international market as well as in the industry, the previous exporter variable translates itself in the lag of the exported value by a firm to know if the firm exported in the previous year. Indeed, on average, firms that exported in the previous period acquire a greater share of their turnover from exports. Conclusions presented in our model are in line with previous works (Castellani, 2002; Fabling & Sanderson, 2013; Batista, Eduardo Matos & Costa Matos, 2017). Once again, a firm that as previously exported is, at first sight, well established in the international market. It takes years to build long-lasting relationships with trade partner as well as to build a wide trade network. Similarly, a firm competing overbroad strives with much more firms and possibly even more competitive and hence, with such a fierce competition a firm must overcome itself and differentiate as well as become more efficient. In this chapter, within the industry, the 3 subsectors behave differently and the measure proves to be statistically significant in all of them. However, if a firm exported in the previous period this will lead on average, ceteris paribus, to an

increase in 6.29 in the export intensity of the Basic Metallurgy firms, 1.21 in the Metal and Electrical Products and 4.03 percentage points in the Transport Equipment. Regarding the probability of exporting in the next period it will increase, respectively, on average, 43, 45 and 50 percentage points if the firm exported in the previous period.

6.5 Labour intensity

Labour intensity is an innovative approach to this kind of study is not intensively studied but we found it very useful four our purpose. Following the indications of Evis Sinani & Bersant Hobdari (2000) we defined it as the number of employees over the turnover. More important than its definition itself it is how we decided to define it and include it. We then stress that in an industry with a high level of assets and capital as well as energy requirements we wanted to capture not only the high (expected) level of capital intensity but all the opposite of Labour intensity. That is why we expected and indeed obtain a negative coefficient for this measure. Following the same percentile approach as before, we analyse the variation comparing to the previous and least labour-intensive percentile. We empirically find that a decrease in labour intensity will lead to more export intensity and a higher likelihood of being an exporter (thus more competitiveness).

Concluding, a positive variation in firm's labour intensity which makes it improve from the previous and least labour-intensive percentile decreases the export intensity of the same in 3.01 percentage points, given us statistical proof that capital intensity influences oppositely and then positively the export intensity. Moreover, the probability of a firm becoming exporter decreases by 2.27 percentage points a period after the change, if labour intensity increases by 1 unit, ceteris paribus.

6.6 Average Wages

The variable average wages per employee is not significant in our two models. This may be due to the assumption that all the employees work the same number of hours (as the Dataset just reports the total number of workers). Moreover, we could not fully control for different levels of human capital inside the firm. However, the main reason for not finding a significant association between wages and competitiveness might be that wages, at least until a certain extent, are correlated with the levels of productivity, measured in our model by the Total Factor Productivity. On the top of that, Capital-intensive firms are associated with more skilled workers, which typically have better salaries. Therefore, variables such as TFP and Labor Intensity can be cannibalizing the outcome of wages on competitiveness.

6.7 Diversification

Our diversification measure proves to have a positive impact on the export intensity and therefore in the competitiveness of firms in our model. This measure, besides being highly statistical significant is defined as export both to European Union and outside of it, making only sense to use in the Fixed-effect models as it is a post-export measure and not possible to validate in the likelihood of a firm to become exporter as is already measuring that. It works as a measure of insurance perceived by the firms since they are pooling risk between different zones, countries and trade partners. This reasoning follows the Batista, Eduardo Matos & Costa Matos, 2017 & Mariasole et al. (2013), approach and it is sustained with the following example: if a firm loses a trade partner the percentage of exports in the turnover is not affected as if it loses the access to a certain trade zone as it might happen to firms from the UK after the

Brexit occurs. Recall that the European Union acts as a 'single market', therefore one might consider exporting outside the European Union to be a bulletproof test for an export firm capacity since to export beyond EU demonstrates more ability to negotiate and explore behind barriers. Consequently, on average, if a firm diversifies it will increase 4.59 percentage points in its export intensity, ceteris paribus.

6.8 Subsidies

Subsidies are given by the Government is related to certain projects as they are given and allocated to firms to improve some conditions and invest in assets and ventures. This possible improvement may help to overcome competition difficulties and hence help improving internationalization and competitiveness of its recipients. With this, we expected a positive coefficient in this indicator as well as different values across sub-sectors. Indeed, in such a heterogenic industry the subsidies attributed impact differently, mainly in the presented case being only statistically significant in an increase in the export intensity, ceteris paribus, by 1.68 percentage points if a subsidy of 100.000€ is given for the Basic Metallurgy. Regarding the decision to export or not the impact differs again across sub-sectors mainly having only statistical significance in the Basic Metallurgy and Metal and Electrical Products with a higher likelihood of 8.54 and 3.46 percentage points, respectively, if the firm is a subsidy recipient. The result of the third sub-sector could be explained by its highly export intensive profile.

A final remark note should be said regarding the omitted effects of this variable. Although it is an important indicator that might help firms to increase its competitiveness the effects themselves studied might be dubious. Firstly, some of these subsidies might not be used to its final proposes or in the direct way of "financing" productivity. Secondly, there are other fiscal ways as these subsidies are received by the firms mainly through fiscal discounts and incentives which were unbearable to include in the model due to the lack of information reported by the firms to the entity of the Database we had used.

6.9 Size

Size should play an important role impacting competitiveness as we would expect large firms to overcome its peers mainly the micro and small firms, hence we should anticipate that the bigger the size the more export intensity captured thus higher competitiveness. Although it is difficult to draw the direction of causality in this indicator we decided to follow the procedure of Ana Luísa Correia & Ana F. Gouveia in 2016 studying for the size in the previous period to have an impact today, accounting for possible changes in the size of a company. Therefore, a positive and statistical coefficient arises for the decision whether to export or not advocating that, the decision of exporting as a positive impact of 8.37 if there is an increase in size to the next category (from small to medium, as an example). Regarding the export intensity, nothing more can be said as the model reported any statistical evidence.

All in all, our results are in line with both positions in literature. In the one hand, Correia & Gouveia (2016) conclude that size is important, as so we did in our Probit model, in the other hand Moen (1999) proposes that small firms are not certainly less competitive. Recall that, as other studies might suggest, our database reflects the Portuguese reality in what firm's sizes are concerned with about half of the studied firms having a micro size. Moreover, in what our sample concerns, if we talk about only large firms they reflect 5.1% of Basic Metallurgy, 0.6% of Metal and Electrical Products and 7.2% of Transport Equipment. Respectively, micro small & medium firms are then 94.9%, 99.4% and 92.8% of the overall industrial composition by sub-sector.

6.10 Financial strength

The financial strength or condition of a firm reflects its financial status and it is expected to play an important role in a firm competitiveness. Being this said, it is intuitive to assume that a firm that has low levels of interests to pay, high EBITDA and good levels of operational profits is more likely to succeed and more likely to be able to export as well. In that sense and following the literature status-quo we decided to study and control for three main indicators.

a) Financial Pressure

A firm where the financial pressure increases by one unit will have a negative impact on its export intensity reducing then its competitiveness. Otherwise, we found a positive effect in the decision to start exporting, which could be explained by the pressure in the internal market in the previous period, but details will no longer be needed since the coefficient is not statistically significant. Financial pressure is the Net interest (Interest paid minus Interest received) over the EBITDA advocating that a firm that feels the pressure of having a high share of interest, the share of its turnover to pay accumulated debts with be significantly high. If not, this firm could invest in other assets as industrial property, software and R&D.

b) Negative equity

Negative equity in pure finance and accounting terms happens whenever liabilities exceed assets. A firm that has a negative equity in the previous period most likely should felt an adverse impact on its export intensity as well as in the decision to start exporting due to financial constraints. Despite no significant effect was appraised in both our models for this variable, these results do not dispel the belief that negative equity is a predictor of a firm competitiveness. As of the decision to export we remain more sceptical since it might indicate no room for improvement but also the need to look for other markets to profit. Bellone et al. (2010) also explores the effects of negative equity on firms and in its balance sheet health summing up his argument by explaining that this indicator is not likely to be present in highly competitive firms.

c) Debt-to-equity

The Debt-to-equity more than a fundamental trigger for competitiveness is an important and informative indicator of the leverage capacity of a firm. This ratio aims to explain the capacity of a firm to contract debt related to its equity and to maintain a healthy ratio in order to invest greatly and pay its debts when possible. Although this neither undermine nor surprise us much the effects of this ratio in the competitiveness or the decision to export is not statistically significant. It is, however, important to study the values of the ratio purely as we have done in previous chapters. A final note concerns the division and efforts we have made to study the heterogeneity in this indicator, following the procedure of interaction as we did with other variables.

Negative equity and Debt-to-equity revisited – the Portuguese Case

Following the conclusions of Batista, Eduardo Matos & Costa Matos (2017) and applying the same reasoning for Portuguese firms several explanations for the inclusion of the two previous pointers might arise. As general knowledge Portuguese law allows firms to be established sometimes with no equity at all or at least, residual values of it. There is indeed overconfidence on the Portuguese firms on debt rather than equity which might bring some future distresses.

This asks for an improved analysis of the meaning of negative equity and the ratios of debt-to-equity in the Portuguese firms. That is, besides being studied separately, the importance of them together is also vital since we can control for the growth of liabilities without an accompanying or subsequent increase in assets. In the latter case, Portuguese companies could have higher debt-to-equity ratios which by themselves might be misleading. In the one hand, one can think that Portuguese have high leverage power being able to contract debt and invest thus increasing competitiveness which will future translate into higher profits and turnovers being then able to pay back the accumulated debt. On the other hand, it might translate into the unresponsiveness of the Portuguese law to these situations while firms go from the simplest case of rolled-over debt as assets depreciate to cases of incapacity of paying at all.

Nevertheless, it could also be perceived that firms may find themselves having negative equity through inefficiencies operations, bad decisions on buying assets or both, turning into the unproductivity of assets purchased. Conversely, if the assets turn themselves to be efficient that might not be enough if this doesn't translate into more productivity, higher turnovers and finally more competitiveness. All in all, along with other literature we expose some problems associated with these measures sideways with the specific Portuguese reality which in the end turn to an ultimate call for further research in order to draw more accurate economic policies.

7. Conclusions, Policy Recommendations and Further Research

This paper examined the triggers of competitiveness of the Portuguese Metalworking industry. After a brief study of the importance and overview of the sector, other studies and literature were studied in order to present a robust model close to the reality of the sector. The authors then present a two-step approach using a Probit and a fixed-effects model that aim to answer the two initial research questions. If in the one hand we want to predict the triggers of competitiveness thru the proxy of the export intensity, we also want, in the other hand, to know what influences firms to start export.

The authors advocate throughout its findings that while determinants of competitiveness vary across firms as well as across the sub-sector there are some characteristics indispensable and very robust to our conclusions. Financial health which was expected to lead to higher significant results on influencing competitiveness negatively turned out not to be that much important in our model. However, more important indicators lead to imperative results in explaining why do firms export and why they decide to increase exports.

The investment in both tangible and intangible assets from some periods ago it is actually robust explaining the capacity of such capital-intensive firms on their performance. Likewise, the Total factor productivity and Labour intensity prove to be pertinent determinants. The firms that get subsidies along with being exporters in the previous period are also major triggers in competitiveness. In that sense, the authors may conclude that firms that used to export, receive subsidies and are, in fact, more Productivity and Capital-intensive will be consequently more competitive as well as more leaning to start exporting and increase exports.

These conclusions give insights into how policy-makers can support an increase in the competitiveness of the Metalworking sector. In such a Heterogeneous industry, a more intensive and detailed analysis was conducted and that encourage even more policy-makers to reinforce the support to such an important industry in the Portuguese economy. The support for more and superior R&D investment as well as other kinds of assets might indeed help the sector. We could also observe the increase in labour productivity of

the sector in spite of an overall salary increase. We can then say that our findings largely corroborate previous works and literature findings, but one must bear in mind some existent drawbacks in the overall analysis. One of them is related to the national market.

On this study internationalization is considered a proxy for competitiveness, however, some firms may also be competitive in the national market. Due to the highly exportable profile of this sector, we decided not to account for this case.

The database used included all the firms of the Metalworking industry between 2010 and 2016. Moreover, it was feasible to have all the economic activities and then choose the relevant ones so we can study and advocate for sub-sector and firm-level heterogeneity. Notwithstanding, many caveats and drawbacks have to be said in order to, in the future, further research can be more compelling and even more backed by data. First, we didn't have the complete and accurate metalworking value chain that might be important to address as some articles mention. Not only this but also the fact that vital data was missing from 2010 backwards was a major shortcoming in the study as we had fewer years to study, yet statistical and scientific robustness is still an asset on this work. Moreover, advance research would profit from databases with better information regarding some important intangible assets as R&D spending, industrial property and investment in software. Likewise, increase education and investment in human resources and more information of the intra-industry possible costs of trading.

Finally, further research could focus on studying the value chain interaction within the subsectors since, as we know, some produce to others and so on and so forth. It goes without saying that data regarding R&D, Human Resources and other types of assets would be valuable to help predict the determinants of the competitiveness if correctly reported from firms to the database holders from now on.

All in all, we stress that for a small open country like the Portuguese economy competitiveness and exports should be handled with care. This research founded that is important to keep diversifying the exporting partners along with keeping investing in fixed tangible and intangible assets controlling for other variables of financial health. Despite the Portuguese metalworking sector being capital intensive, a regular investment in an R&D and H&R should be imperative since the high productivity of the sector also depends on qualified workers that have the sufficient know-how to deal with the heavy machinery and keep the industry in the right track both nationally and internationally.

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